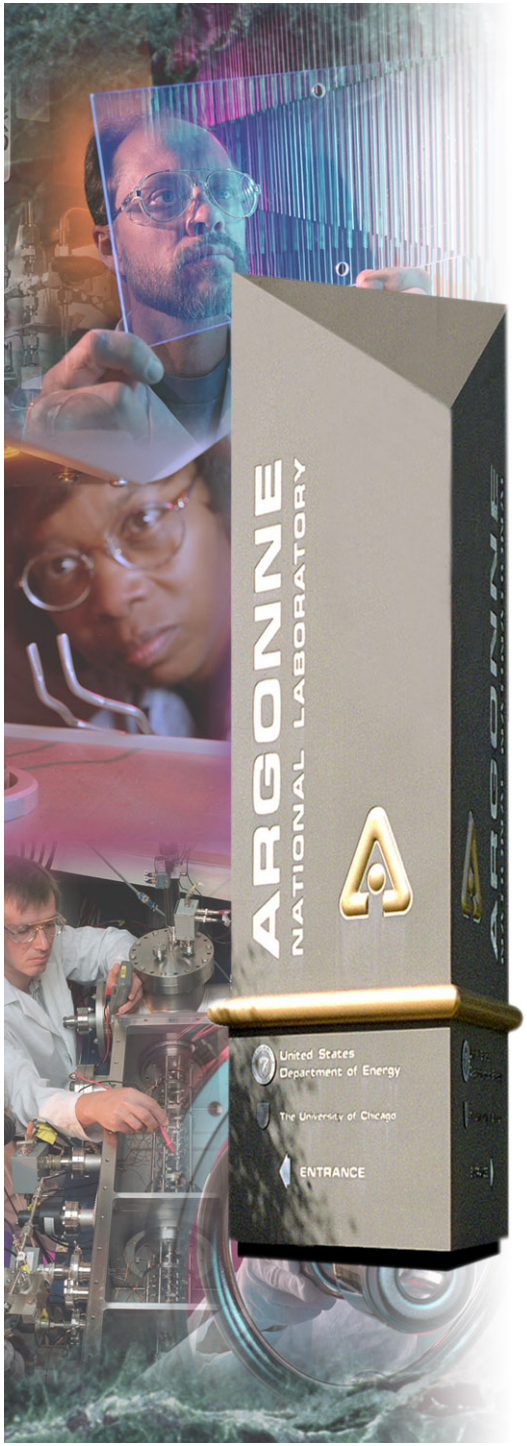


Argonne National Laboratory Overview

Office of Technology Transfer

Argonne National Laboratory

Office of Science
U.S. Department of Energy

A U.S. Department of Energy
Office of Science Laboratory
Operated by The University of Chicago

About Argonne

- **Founded in 1943, designated a national laboratory in 1946**
- **Managed by The University of Chicago for the Department of Energy**
  - ~4000 employees and 4000 facility users
  - ~$558M budget
  - 1500-acre site in Illinois
  - 800-acre site in Idaho
- **Broad R&D portfolio**
- **Numerous sponsors**

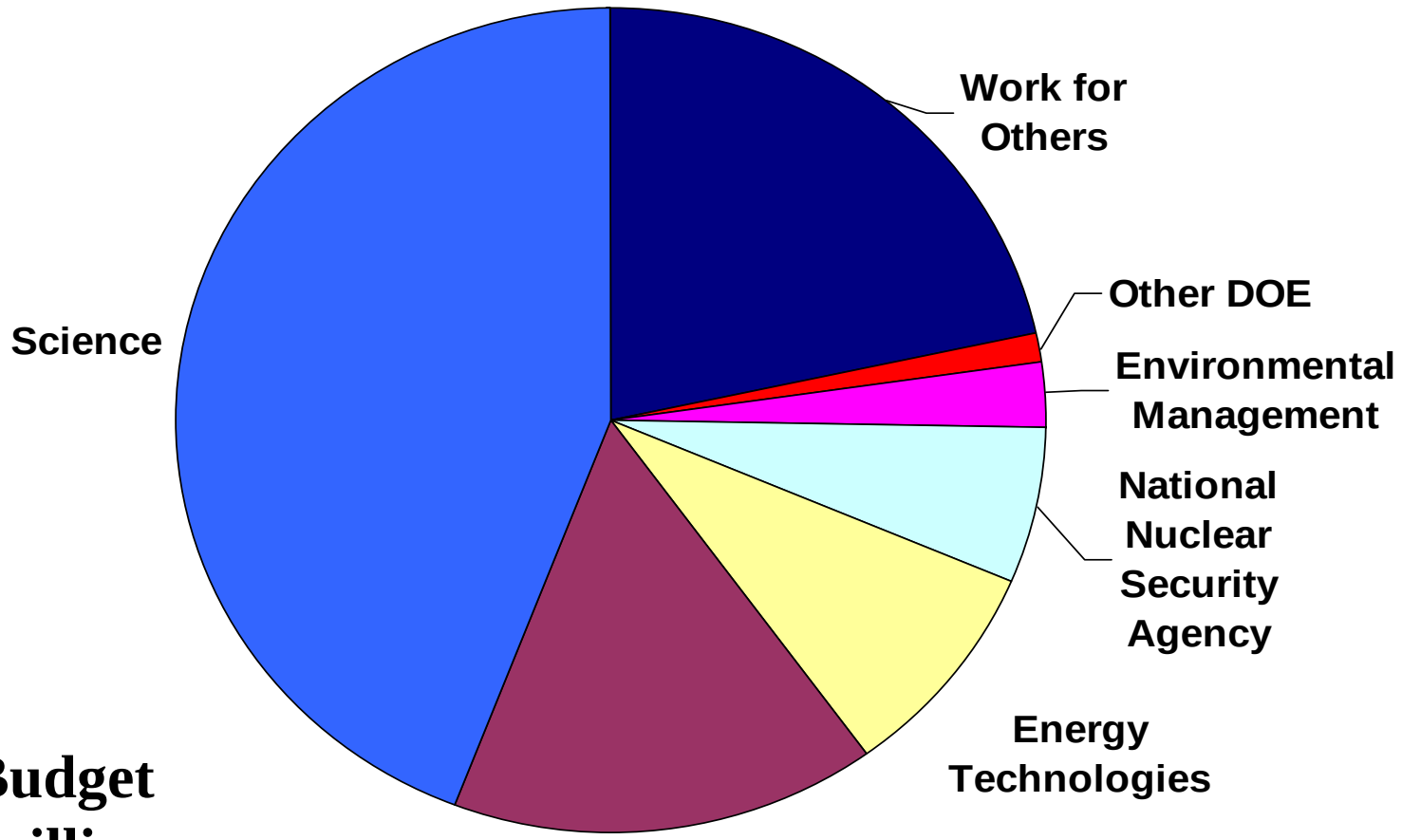
Argonne's Mission

- **Serve DOE & national security**
  - Advancing the frontiers of knowledge
  - Creating and operating forefront scientific user facilities
  - Providing innovative and effective tools and solutions for energy and environmental challenges to national and global well-being, in the near and long term
- **In accomplishing its mission, Argonne partners with DOE, other federal labs, academia, and the private sector**

Forefront Science and Engineering

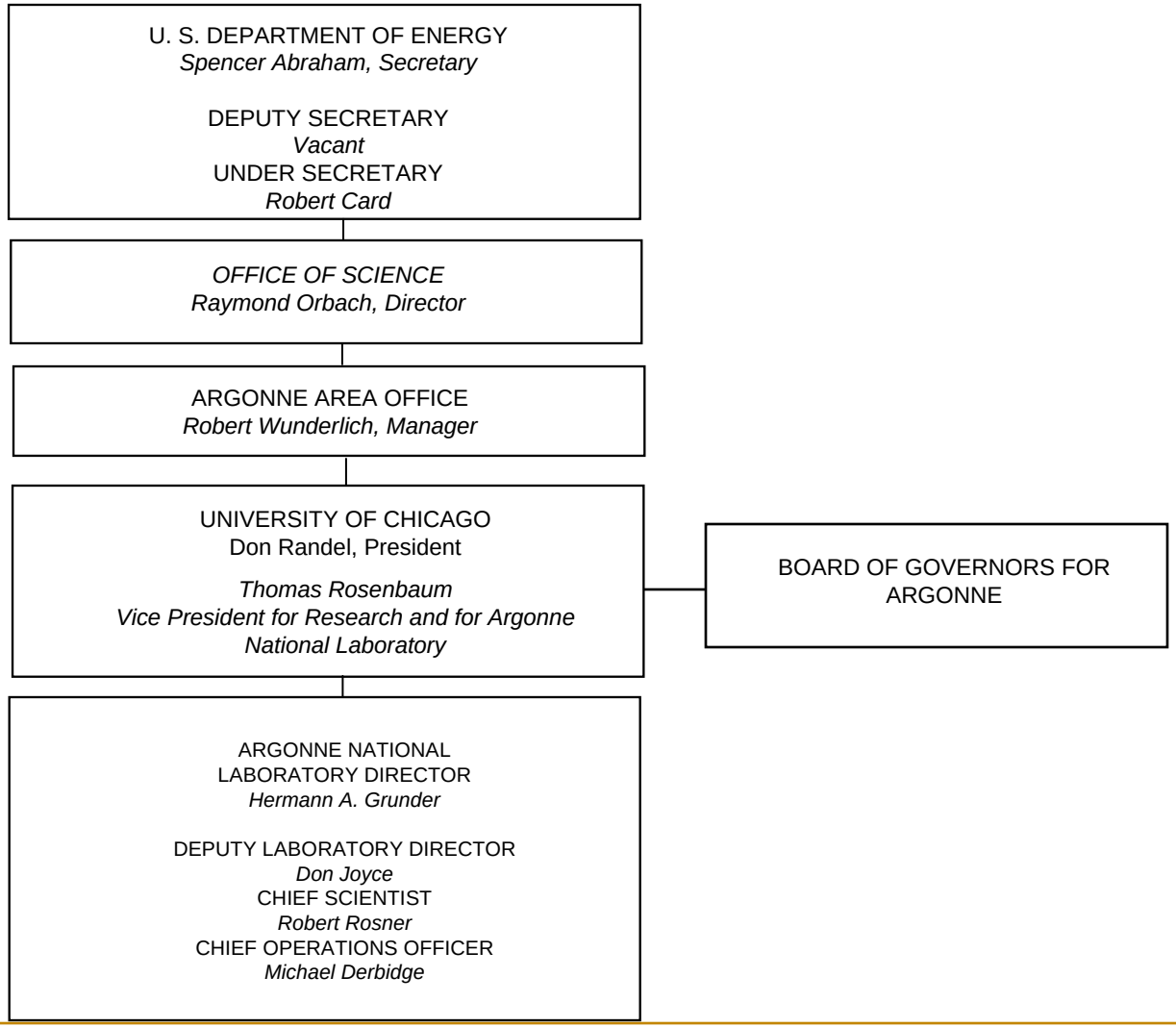
- **Basic and applied research**
  - Materials and chemical sciences and engineering
  - High-energy, nuclear, and atomic physics
  - Multidisciplinary nanoscience and nanotechnology
  - Structural biology, functional genomics, and bioinformatics
  - Energy & Environmental science, technology, and assessment
  - Transportation technology
  - Computer science and applied mathematics
  - Computational science
- **Design, construction, and operation of accelerator-based user facilities**
- **Design, development, and evaluation of advanced nuclear energy systems and proliferation-resistant nuclear fuel-cycle technologies**

Broad R&D Portfolio Serving National Needs

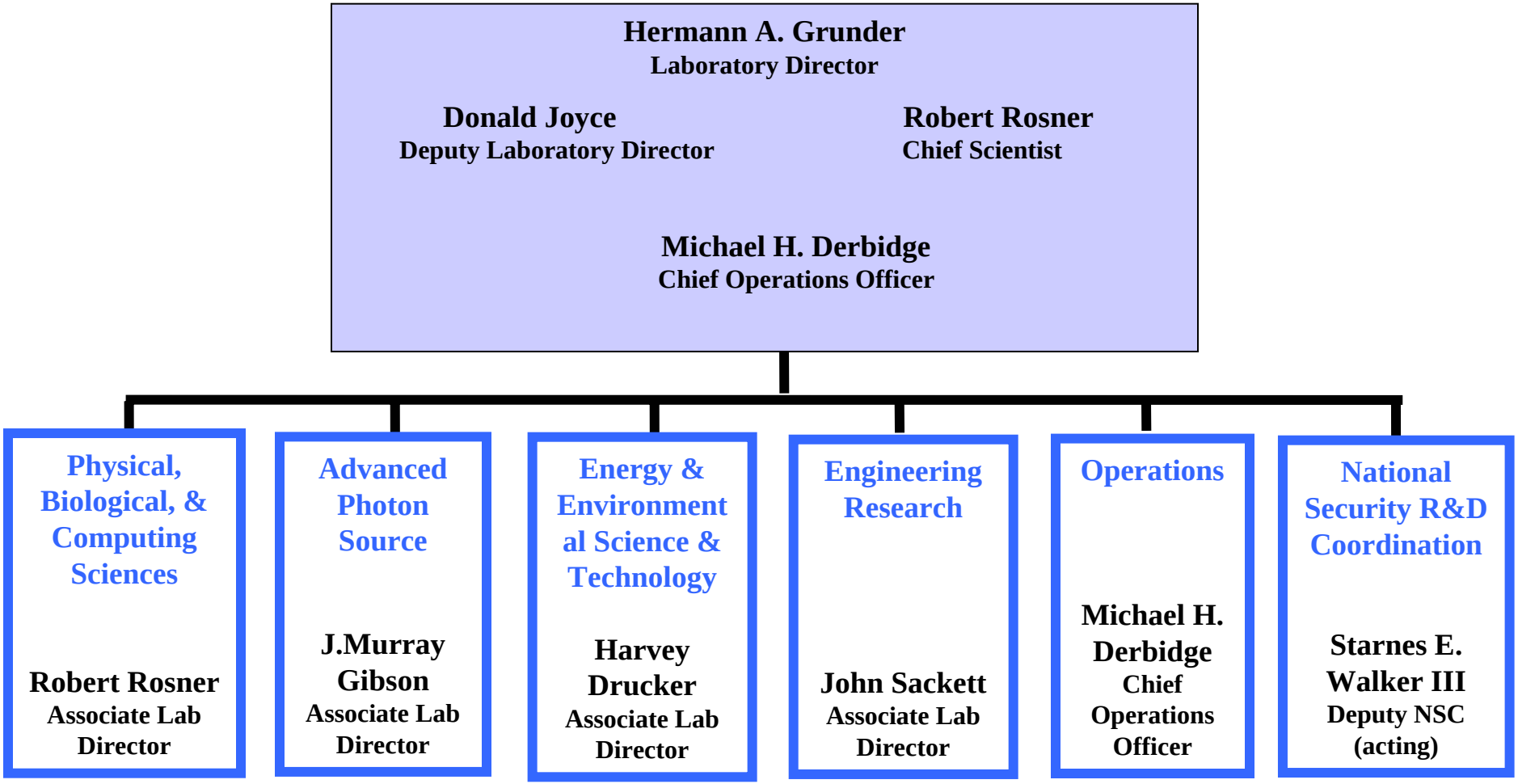


Total Budget ~$558 million

Argonne is a DOE Science Laboratory



Argonne Organization



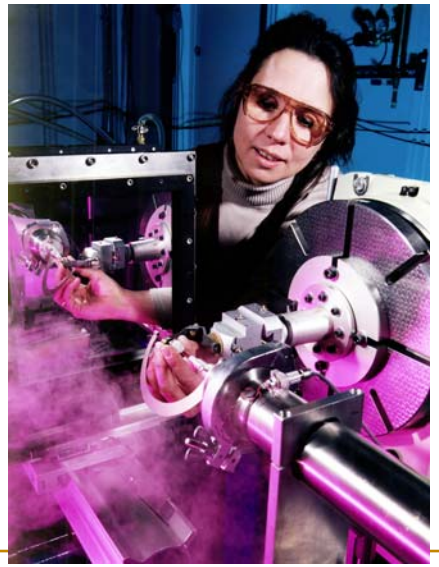
- **22 Scientific/technical divisions**
- **10 Operations/support organizations**

Partnership Opportunities

- **User facility access**
  - Advanced Photon Source (APS)
  - Intense Pulsed Neutron Source (IPNS)
  - Argonne Tandem Linac Accelerator System (ATLAS)
  - Many others
- **Participation in Argonne's Major initiatives**
- **Industrial R&D partnerships/agreements**
- **Topical workshops and 'summer schools'**
- **Science and engineering collaborations on other projects of mutual interest**
  - Faculty and student research
  - Educational outreach

Advanced Photon Source

- Nation's most brilliant hard x-ray beams
- Materials science, chemistry, biology, protein crystallography, earth & environmental science, physics…
- 42 beamlines in operation
- Over 3000 users
- Operates year-round, 5000 hours/year
- Reliability over 95%
- Innovative x-ray instrumentation and operating modes
- **Contact: Murray Gibson, gibson@anl.gov, 630.252.7990**
  http://www.aps.anl.gov/

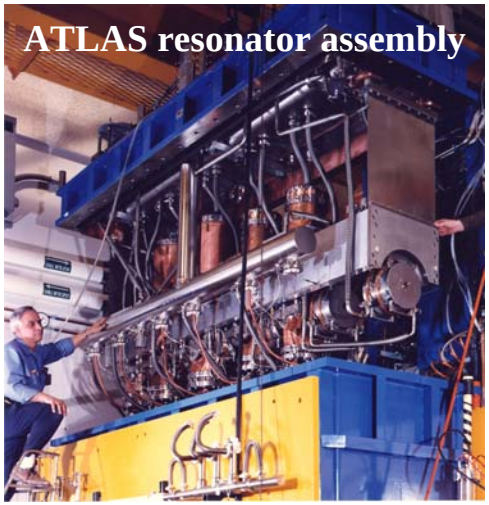


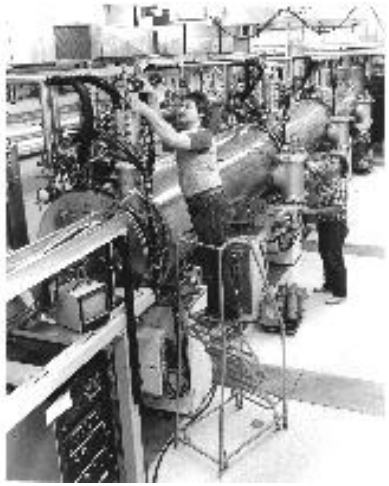
Intense Pulsed Neutron Source (IPNS)

- Pulsed thermal and cold neutron beams
- Materials science, chemistry, biology, physics, geology, nuclear science, engineering sciences
- 13 instruments
- 240 users/visitors per year
- Reliability >95%
- Instrument and technique innovation
- Instrumentation and user-community development for Spallation Neutron Source (SNS) being built at Oak Ridge
- **Contact: Ray Teller, rteller@anl.gov, 630.252.4999; http://www.pns.anl.gov/**

Argonne Tandem Linac Accelerator System (ATLAS)

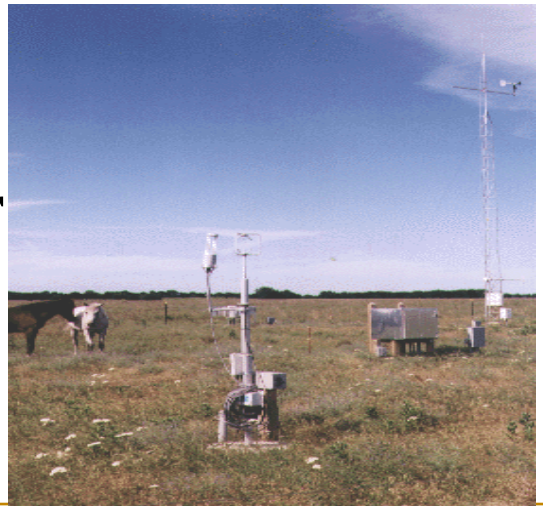
- Low-energy, precision beams of any ion from protons to uranium
- Nuclear physics
- 8 experiment areas
- Over 350 active users
- >95% reliability
- Scientific and technical base for Rare Isotope Accelerator
- Low-beta superconducting accelerator technology
- **Contact: Jerry Nolen: nolen@anl.gov, 630.252.6418; http://www.phy.anl.gov/atlas/**





Energy and Environmental Science and Technology

- **Energy systems and technologies**
- **Environmental assessment, research, technology, and restoration**
- **Transportation, industrial energy and efficiency**
- **Decision and Information Sciences**
  - **Infrastructure Assurance Center**



Engineering Research

- **Advanced nuclear technology**
- **Chemical engineering and electrometallurgical technology**
- **Radioactive and mixed waste treatment technology**
- **Nuclear nonproliferation**
- **Nuclear facility decontamination and decommissioning**

➢ **A world leader in nuclear reactor and fuel cycle research.**

Future Workforce Development & Educational Outreach

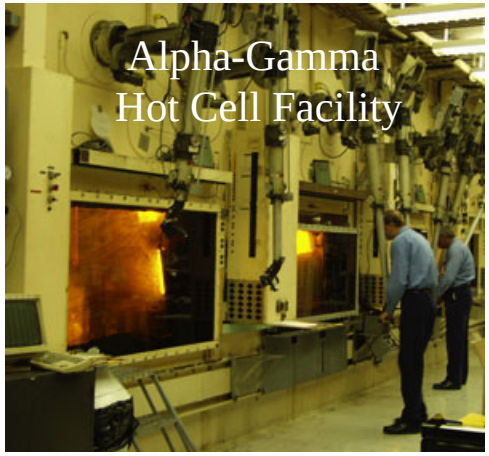
Challenge: Enrich science education and help prepare tomorrow's scientists and engineers

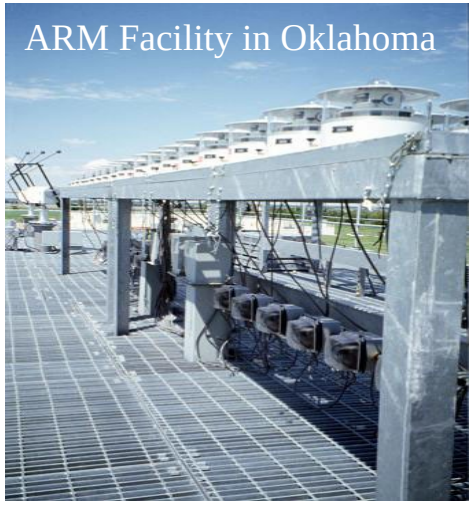
Approach:

- Research opportunities for undergraduates
- Research partnerships between faculty and Argonne
- Support of K-12 science education in the community

Other Significant R&D Facilities

- Electron Microscopy Center **www.msd.anl.gov/groups/emcmr/**
- Atmospheric Radiation Measurement (ARM) program **www.arm.gov**
- Transportation Technology R&D Center **www.transportation.anl.gov**
- DOD approved Dilute Chemistry Facility **www.es.anl.gov/htmls/RDTE.html**
- Alpha-Gamma Hot Cell Facility **www.et.anl.gov/sections/ip/facilities/aghcf.html**
- Argonne-West nuclear facilities in Idaho **www.anlw.anl.gov**
- Many more: **www.anl.gov/OPA/progs.htm#sf**

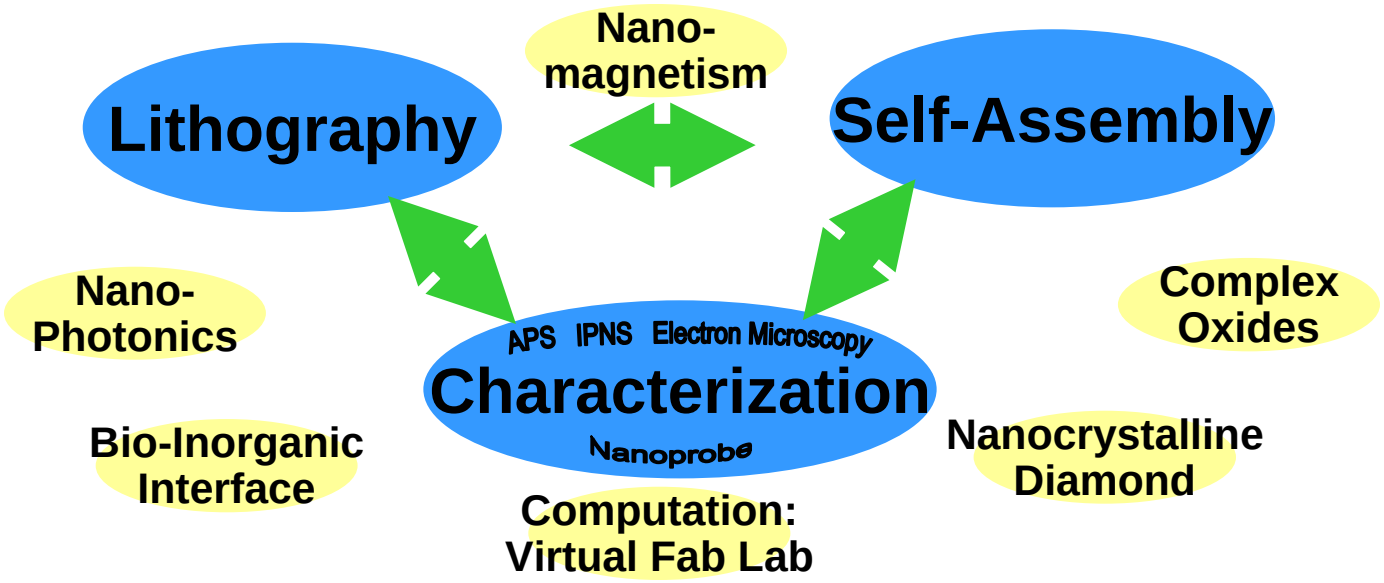




Argonne's Major Initiatives

- **Nanoscience and nanotechnology: Center for Nanoscale Materials**
- **Petascale computers and computational science**
- **Rare Isotope Accelerator**
- **Bioscience: functional genomics**
- **Advanced nuclear fuel cycle**
- **Homeland security**

Center for Nanoscale Materials



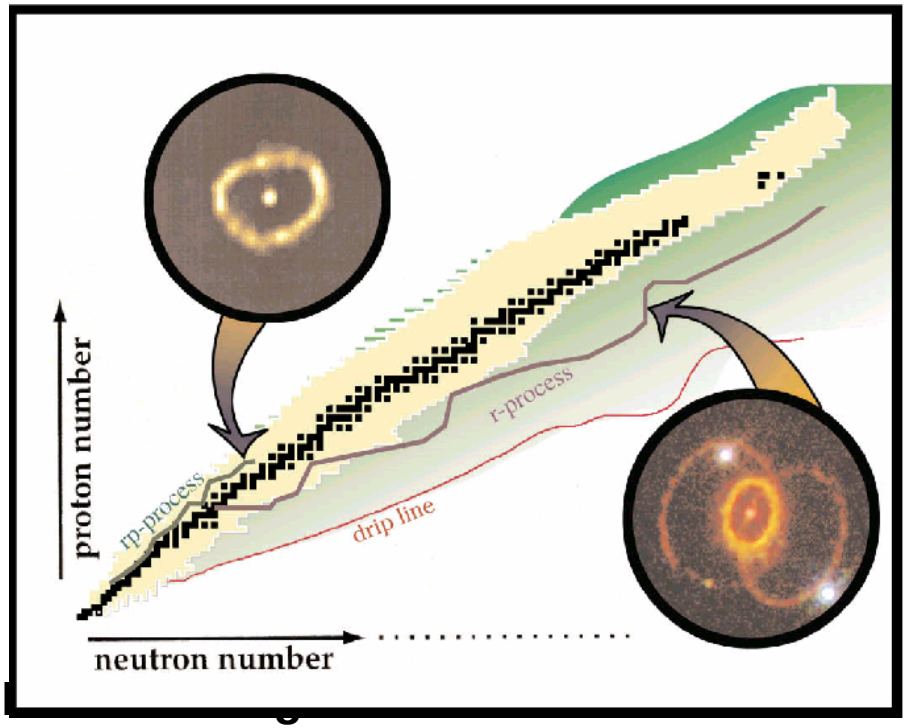
- One of DOE's five new Nanoscale Science Research Centers
- Forefront, interdisciplinary scientific themes
- State-of-the-art facilities and instrumentation; exploiting Advanced Photon Source and Intense Pulsed Neutron Source
- **For information: Sam Bader: bader@anl.gov, 630.252.4960; http://nano.anl.gov/**

Advanced Computing

- **Strong ongoing programs with national impact**
  - Grid Computing: Globus, GridFTP
  - Scalable numerical tools: PETSc
  - Parallel computing: MPI, MPICH, Jumpshot
  - Advanced visualization: μMural, AccessGrid
- **Advanced Computing Initiative**
  - Data-intensive science/advanced Grid technologies
    - Bioinformatics, APS CATs, RIA/LHC, …
  - Complex systems science
    - Whole-cell modeling
    - Virtual Fab Lab/nanoscience: self-assembly
  - Petaflop computing
    - TeraGrid update & TeraGrid facility (NSF)/DOE Computing Initiative
    - Maintaining momentum, and responding to the Japanese challenge
- **For information: Rick Stevens, stevens@mcs.anl.gov, 630.252.3378; http://www.mcs.anl.gov/**

Rare Isotope Accelerator (RIA)

- **Proposed new ~$1 billion research facility is highest priority new construction for nuclear physics**
  - Beams from protons to uranium
- **Exciting science**
  - The nature of nucleonic matter
  - The origin of elements
  - Energy generation in stars
  - Tests of symmetries and fundamental conservation laws
- **Important applications**
  - Stockpile stewardship
  - Radioactive ion implantation
  - Medical isotope R&D
- **National RIA team is forming around**
- **For information: Don Geesaman: geesaman@anl.gov, 630.252.4004; http://www.phy.anl.gov/ria/**



Bioscience

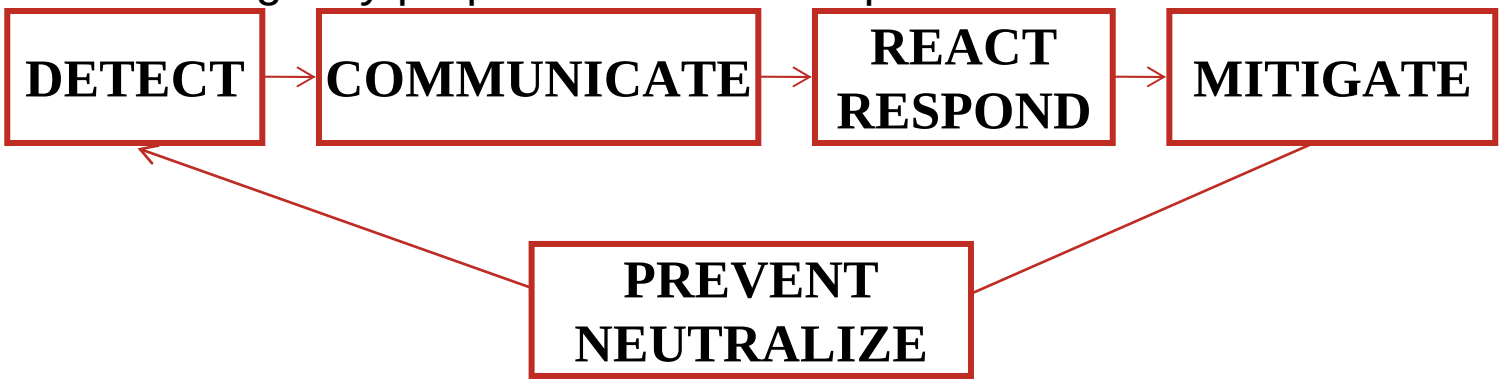
- **Major science foci**: structural biology, functional genomics, bioinformatics
- **Major facilities**:
  - Structural Biology Center at APS — *Structure determination*
  - Midwest Center for Structural Genomics — *High-throughput analyses*
  - APS, IPNS, … — *Neutrons and x-rays*
- **Technical capabilities**
  - Computing — *Simulations and modeling*
  - Nanotechnology — *Self-assembly, …*
  - Robotics — *High-throughput*
- **New directions: bioinformatics and functional genomics**
- **For information: Lee Makowski: lmakowski@anl.gov, 630.252.3819; http://www.bio.anl.gov/**

Advanced Nuclear Fuel Cycle

- **Demonstrate closed nuclear fuel cycle that consumes potential weapons material and simplifies nuclear waste storage requirements**
  - **Reprocess spent nuclear fuel on a pilot-plant scale to extract remaining 98% of available energy**
  - **Separate short-lived fission products from spent fuel for geological repository**
  - **Recycle U, Pu, and minor actinides and consume in reactor fuel**
- **Address key concerns of the public**
  - **Ensure that the disposition and management of spent fuel and nuclear waste is safe and environmentally acceptable**
  - **Keep nuclear materials from diversion to weapons or terrorist use**
- **Provide energy that is safe, greenhouse-gas-free, and economically competitive**
- **International partnership involving governments, industry, labs, and universities is forming now**
- **For information: John Sackett: john.sackett@anl.gov, 630.252.4856; http://www.era.anl.gov/**

Argonne's Homeland Security Resources

- **Expertise, knowledge, technologies, and specialized research facilities developed over decades for other purposes**
  - Nuclear
  - Chemical and biological
  - Systems-level risk analyses
  - Emergency preparedness and response



- **For information: Harvey Drucker: drucker@anl.gov, 630.252.3804**

Partnerships with Industry

- **Cooperative R&D agreements**
- **R&D contracts utilizing unique ANL skills and technology**
- **Technical service agreements to access unique facilities**
- **Technology license for commercial use**
- **Consortia membership, e.g.**
  - Advanced Transportation Technology Consortia
  - National Security Technology Partnerships
  - Central States Universities Consortium
- **Innovative start-ups & new ventures**
- **For information: Steve Ban: sdban@anl.gov, 630.252.8111; http://www.techtransfer.anl.gov/**

Cost-Shared R&D Under a CRADA

Under a Cooperative Research and Development Agreement (CRADA):

- **Federal laboratory(ies) and nonfederal/industrial partner(s)**
- **Parties generally share R&D costs**
  - Lab work may be funded by government (DOE, other agencies) or partner
  - No funds from lab to CRADA partner
- **Company has the right to retain ownership of intellectual property it develops under the CRADA**

Cost-Shared R&D Under a CRADA (continued)

- **Laboratory has the right to retain ownership of intellectual property it develops under the CRADA**
- **Company may obtain (by negotiation with the laboratory) rights to intellectual property developed by the laboratory**
- **Data may be withheld from public disclosure for up to five years**

Reimbursable R&D (Work for Others)

Under reimbursable research and development (Work for Others, WFO) agreements:

- **Work is performed by Argonne**
- **Generally, full costs paid by industrial partner**
- **Under certain circumstances, company may obtain title to intellectual property created under WFO**
- **Research results may be kept proprietary and are not subject to public disclosure**

Licensing

- **Supports cooperative agreements**
- **Background inventions available**
- **Options are available**

Technical Assistance

Argonne helps companies with short-term technical problems in areas of expertise not available commercially

- **Reimbursable Technical Services Agreement**
  - May not involve research
  - Not limited in scope or cost
  - Company or other organization pays full cost

Research Facilities

- **All Argonne facilities may be utilized via customary working arrangements**
- **"Designated user facilities" are intended for shared use by industry, universities**
  - Large, one-of-a-kind research facilities
  - Use may be proprietary (fee charged) or nonproprietary (no fee charged: project must meet certain criteria, and results must be shared openly)

Working with Foreign Companies

- **Possible relationships between Argonne and foreign companies:**
  - Cost-shared R&D
  - Fully reimbursable R&D or technical service
  - Nonexclusive licensing of patents and copyrights
  - Consultant arrangements and other technical collaborations
- **DOE establishes certain limitations that are reviewed on a case-by-case basis**

Licensed Inventions on the Market or in Industrial Use

- **Chemical extractor**
- **Real-time laser weld monitor**
- **Partial Oxidation Reforming Catalyst**
- **Biological microchip ("biochip") analyzer and loader**
- ***Ceramicrete* phosphate-bonded ceramic**
- **Excimer laser for angioplasty**
- **Electron microscope plasma cleaner**
- **Leukemia antibodies (hybridomas)**
- **Nanophase materials**
- **Separation resins**
- **Superconducting powders/bearing levitators/sputtering targets/precursor materials/current lead connectors**

Licensed Software on the Market or in Industrial Use

- **MSET (sensor calibration and monitoring)**
- **GCTool (fuel cell modeling)**
- **LDAP (Internet library browser)**
- **ADIntrinsics & SparsLinc (ADIFOR) (automatic differentiation of Fortran 77 programs)**
- **Casting Process Simulator (CaPS) (modeling casting processes)**
- **Experimental Physics & Industrial Control Systems (EPICS)**
- **General Geometry Transport, 2D (GTRAN2)**
- **Message Passing Interfaces Parallel Computing (MPICH) (implementation of the Message Passing Interface Standard)**